

CLAIMS

What is claimed is:

1. An apparatus for cleaning a surface within a vessel having a vessel wall separating a vessel exterior from a vessel interior and having a wall aperture, the apparatus comprising:
an elongate conduit having an upstream first end and a downstream second end and positioned to direct a shockwave from the second end into the vessel interior; and
an inspection camera apparatus comprising:
a head held in an operative position within the vessel interior;
a light source, at least a light emitting element of said source carried by the head; and
a camera, at least an incident lens of said camera carried by the head so as to capture light from said source as returned by said surface.
2. The apparatus of claim 1 further comprising:
a source of fuel and oxidizer coupled to the conduit to deliver the fuel and oxidizer to the conduit; and
an initiator positioned to initiate a reaction of the fuel and oxidizer to produce the shockwave.
3. The apparatus of claim 1 wherein:
the camera is carried essentially within the head; and
the light source is carried essentially within the head.
4. The apparatus of claim 1 wherein the camera apparatus further comprises:
a cooling fluid-carrying support member.
5. The apparatus of claim 1 wherein:
the support member has a main portion and a distal portion at least partially transverse thereto.
6. The apparatus of claim 1 wherein:
the surface is an exterior surface of at least one tube in a first tube bundle;
the support member extends between the first tube bundle and a second tube bundle;
and

the head is positioned between first and second tubes of the first tube bundle.

7. An inspection camera apparatus comprising:
 - a head held in an operative position within the vessel interior;
 - a light source, at least a light emitting element of said source carried by the head;
 - a camera, at least an incident lens of said camera carried by the head so as to capture light from said source as returned by said surface;
 - a support mechanism for holding the head in an operative position; and
 - a cooling fluid flowpath at least partially through the support mechanism.
8. The apparatus of claim 7 wherein:
 - the camera is a CCD camera.
9. The apparatus of claim 7 wherein:
 - the support mechanism includes main portion and a distal portion essentially normal thereto.
10. The apparatus of claim 9 wherein:
 - support mechanism contains lines carrying signal communication from the camera and power to the light source, the lines being cooled by the cooling fluid.
11. The apparatus of claim 7 used in combination with a detonative cleaning apparatus.
12. A method for cleaning a surface within a vessel of a piece of industrial equipment, the vessel having a wall with an aperture therein, the method comprising:
 - introducing fuel and oxidizer to a conduit;
 - initiating a reaction of the fuel and oxidizer so as to cause a shockwave to impinge upon the surface; and
 - using a camera having an integral light source within the vessel to inspect the surface while the industrial equipment is in operation.
13. The method of claim 12 performed in a repeated sequential way.
14. The method of claim 12 further comprising:

cooling a camera head.

15. The method of claim 12 further comprising:
inserting the camera between adjacent first and second tube bundles and then between first and second tubes of the first bundle.